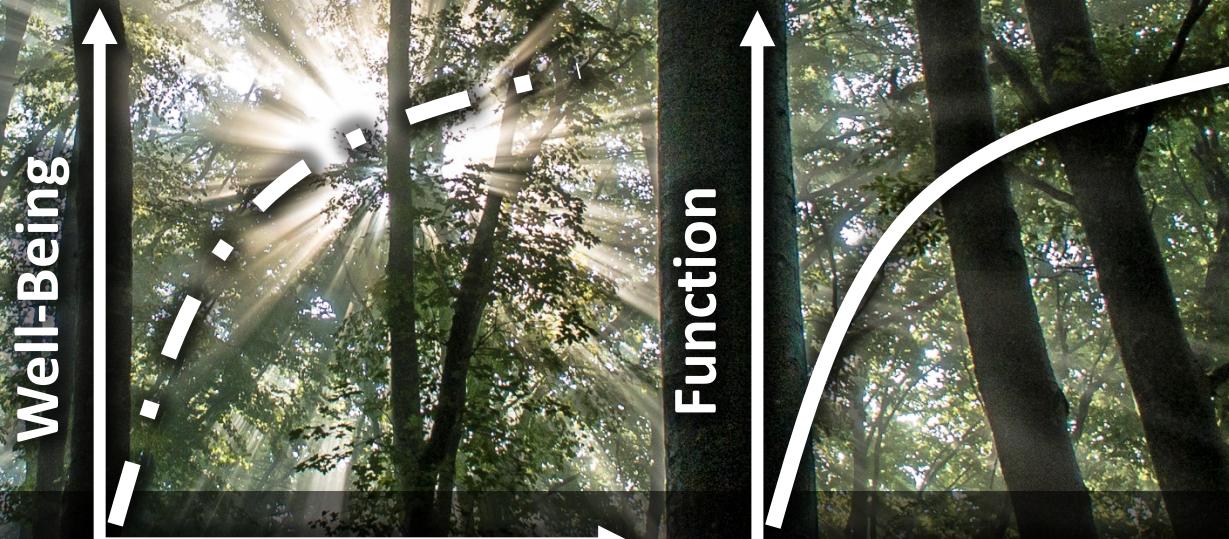




Jet Propulsion Laboratory
California Institute of Technology

Remote sensing of plant functional diversity from space: The potential of GEDI and SBG over California

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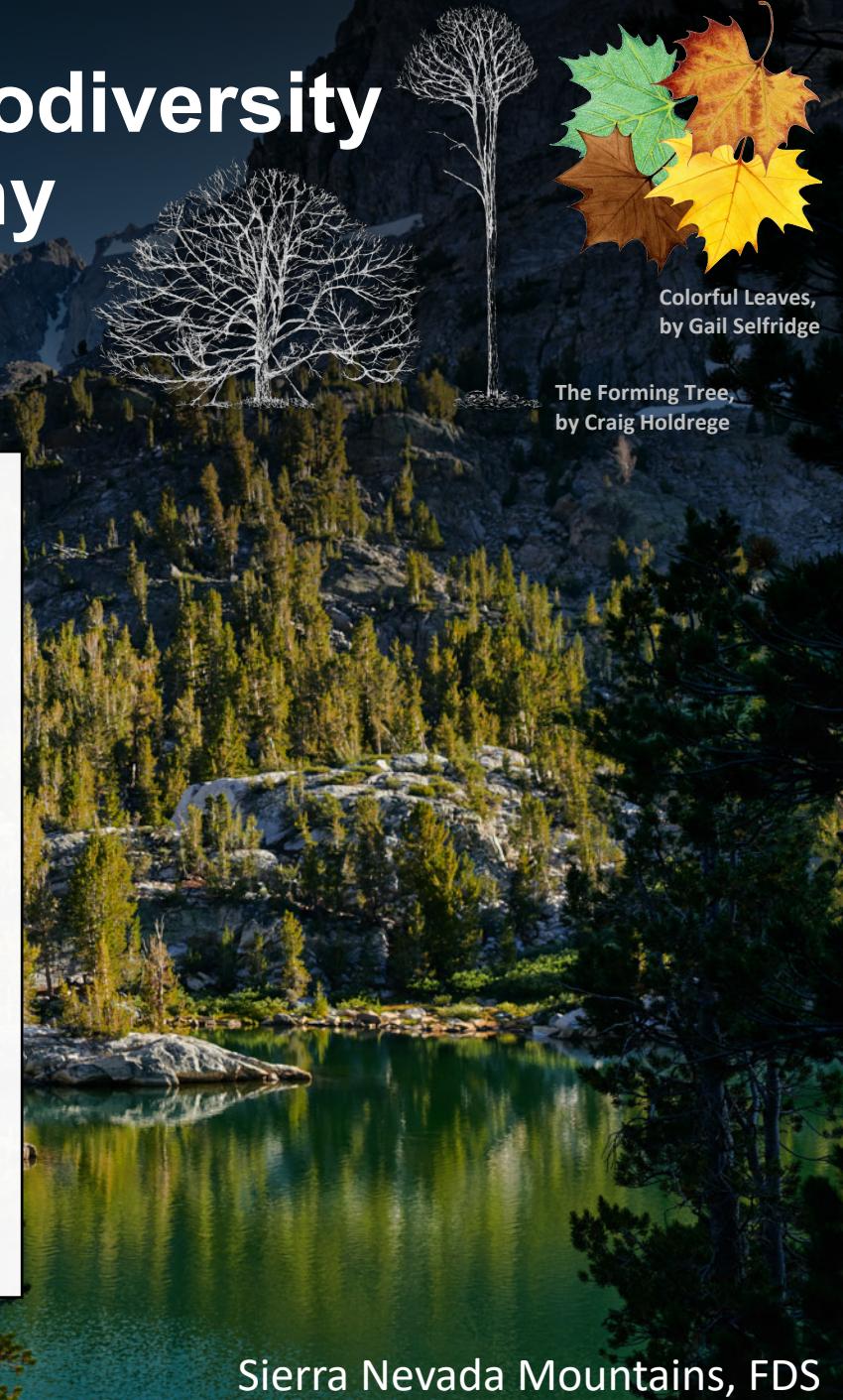
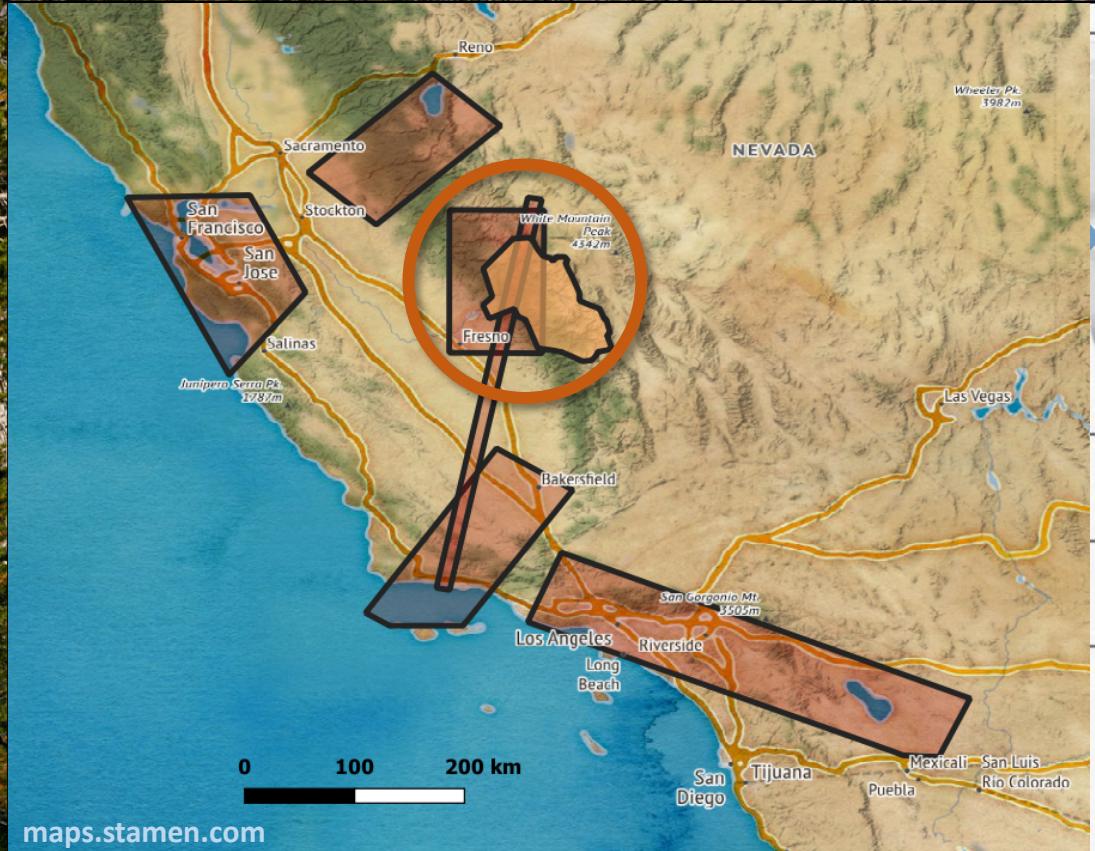


AGU Fall Meeting 2019
9 December 2019, San Francisco

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(3) University of Zurich, (4) University of Edinburgh, (5) University of Maryland

What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space?

Question E-1, Decadal Survey 2017

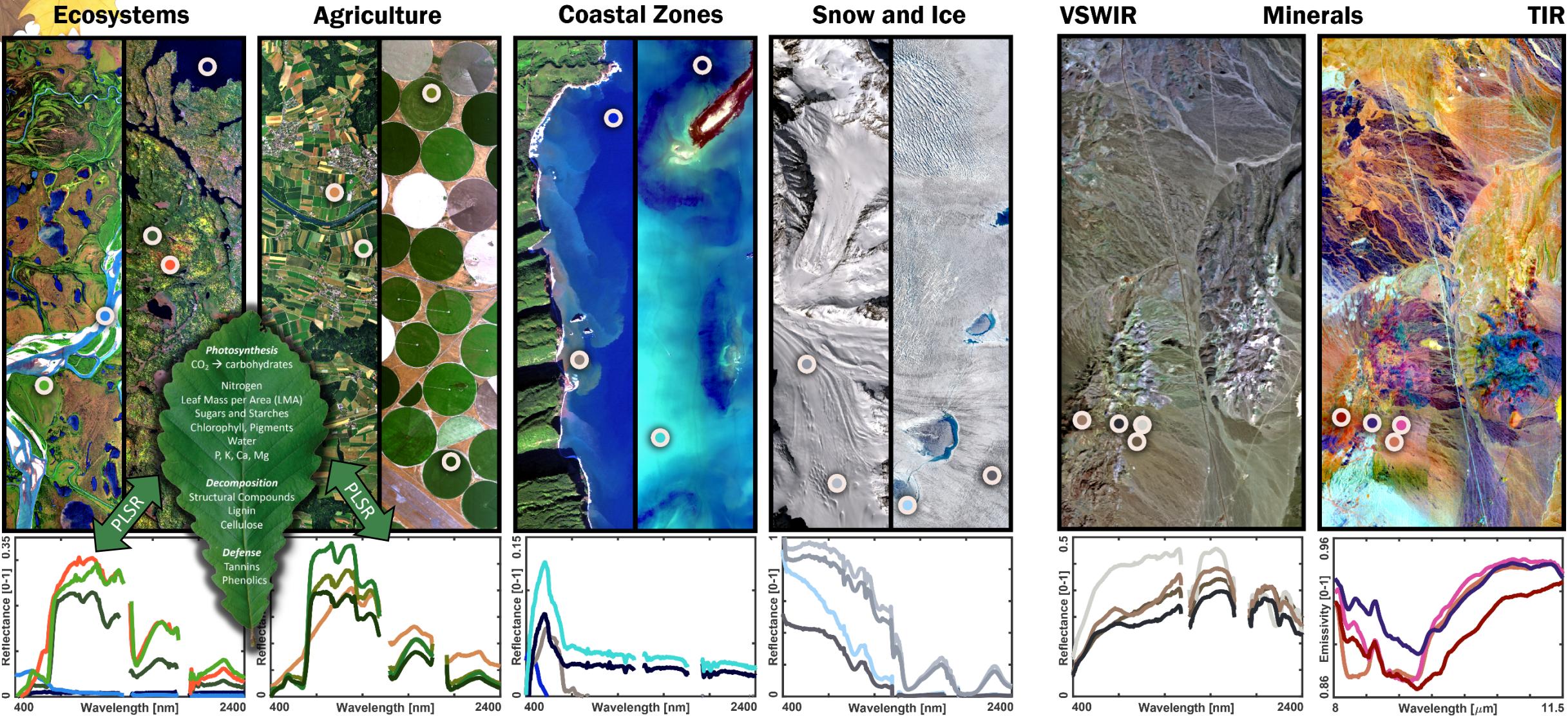


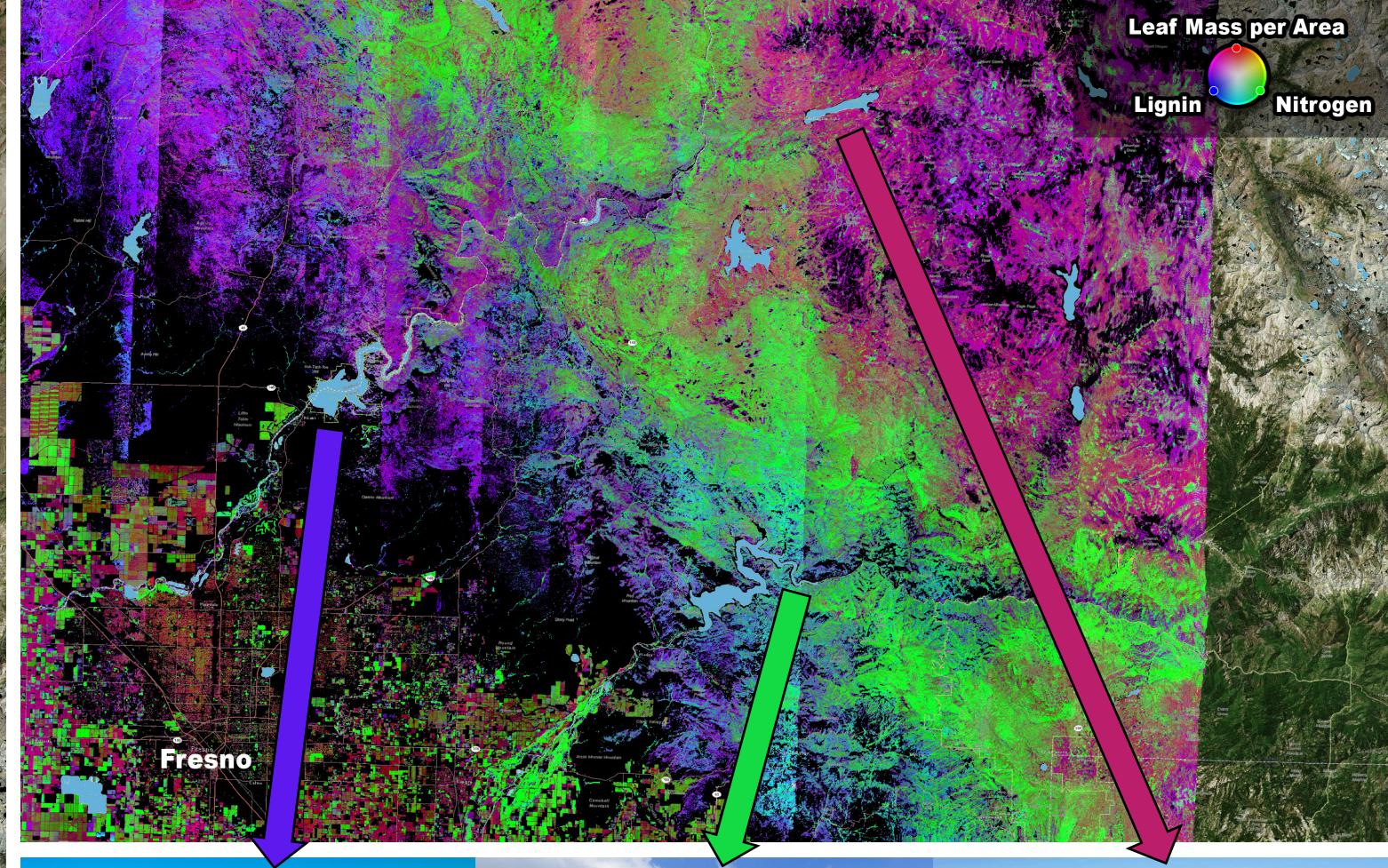
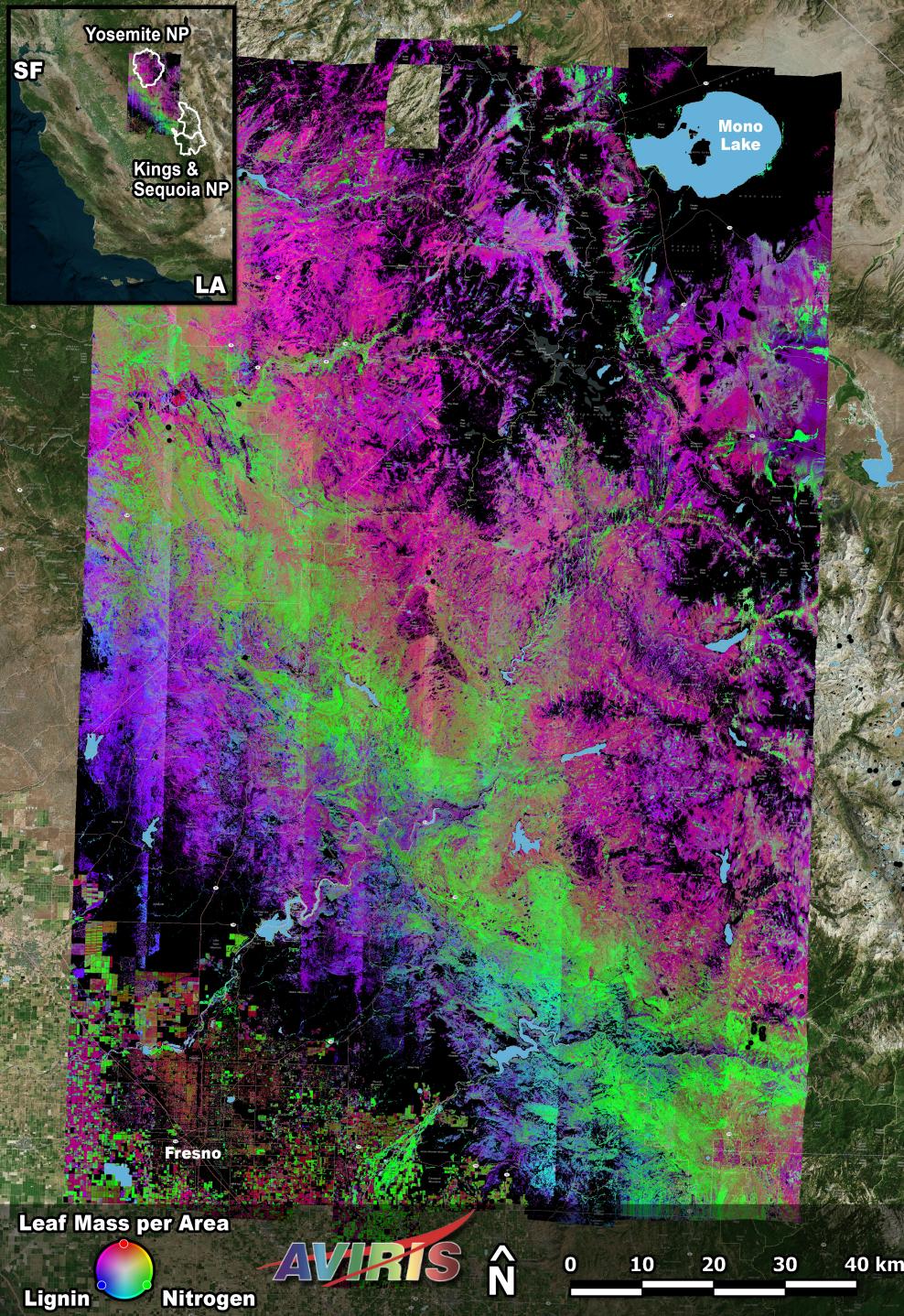
The Forming Tree,
by Craig Holdredge



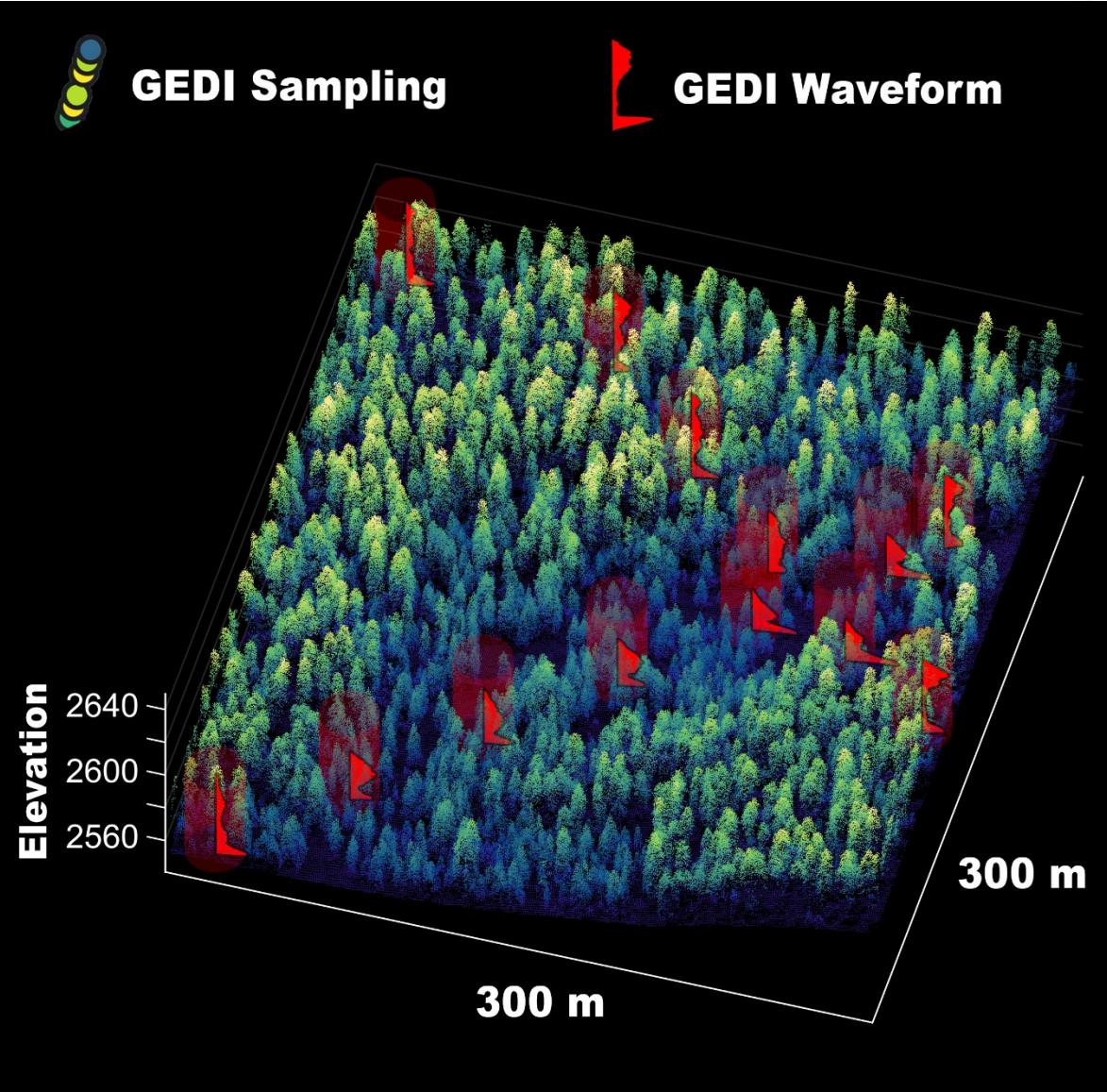
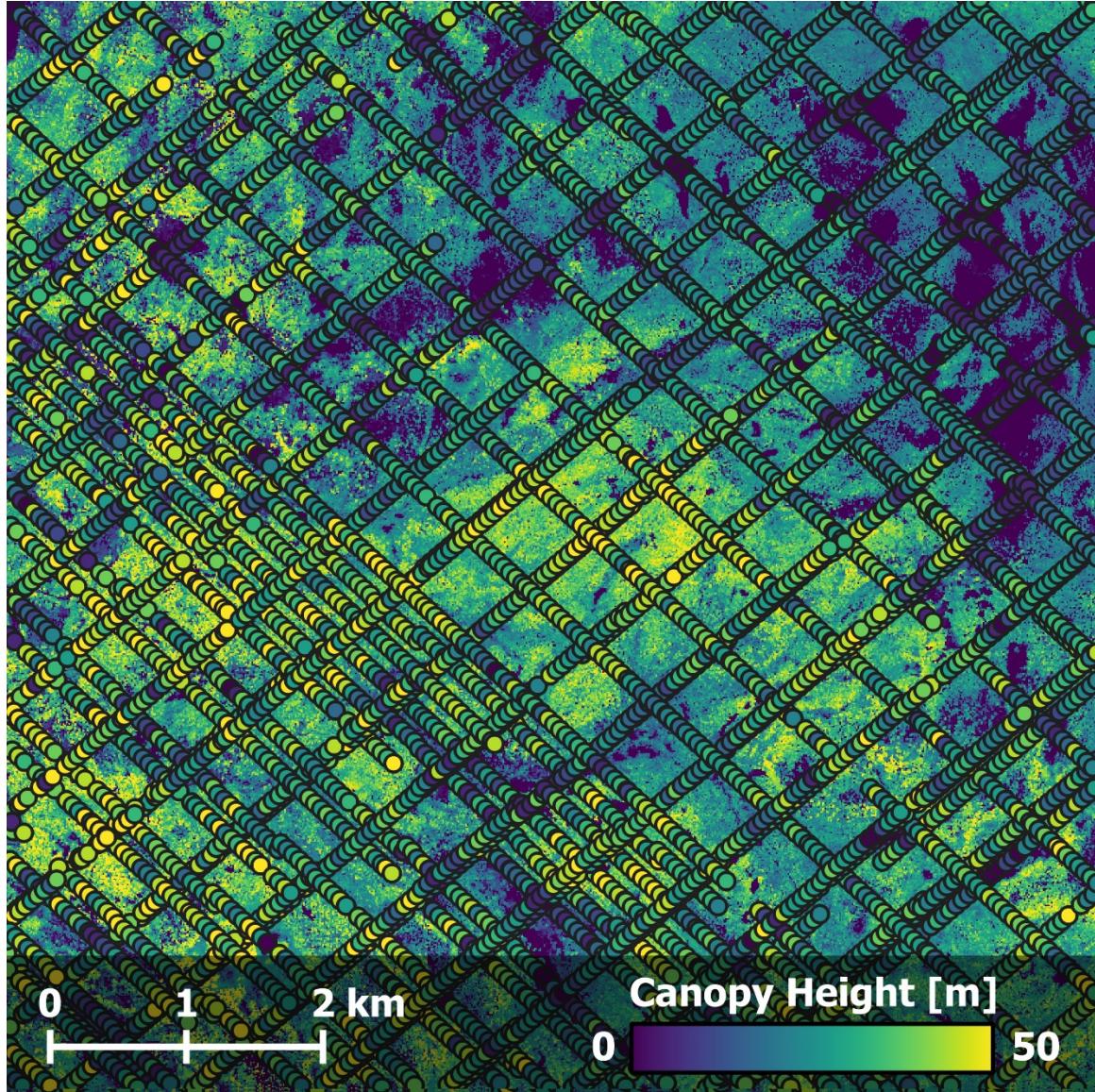
SBG provides data for many focus areas ...

... and will see the world in two critical spectral regions



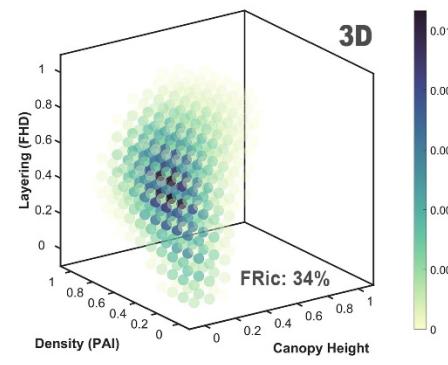
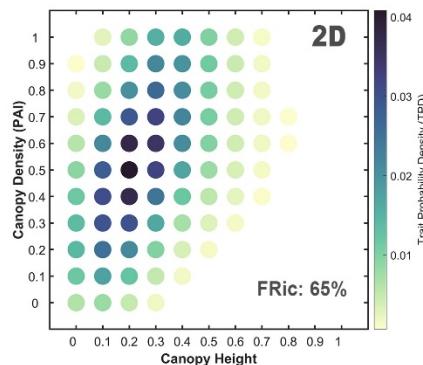
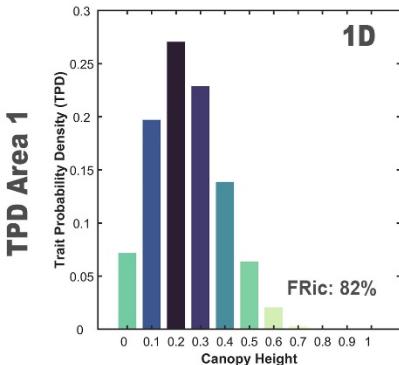


Can we observe structural diversity from space?

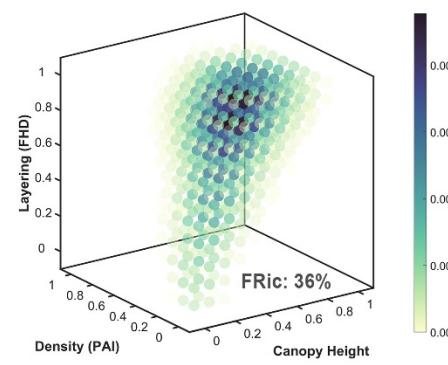
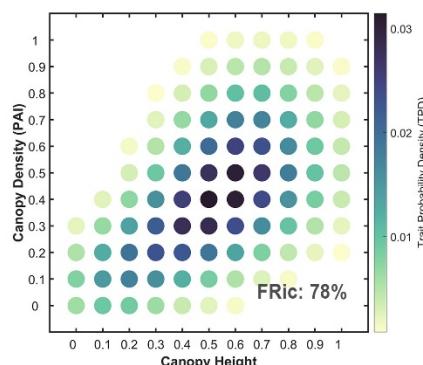
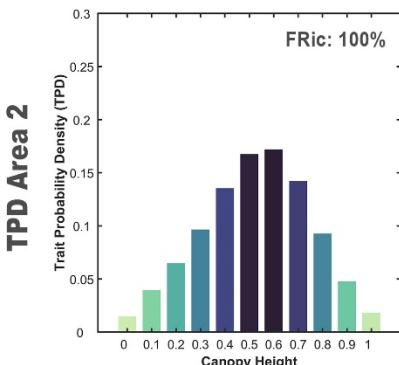
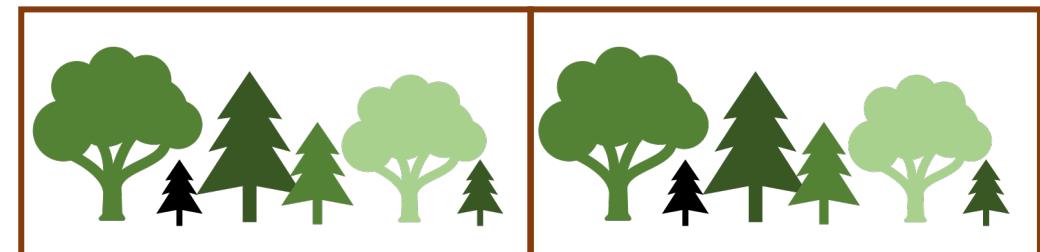


Functional Diversity

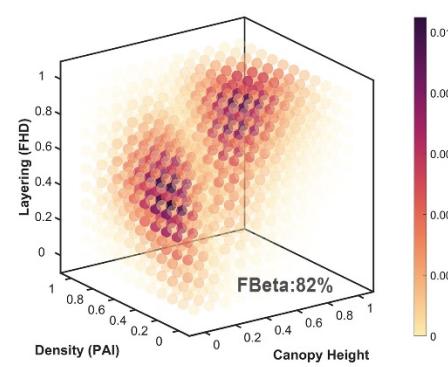
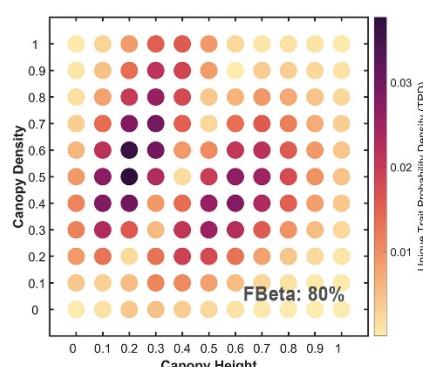
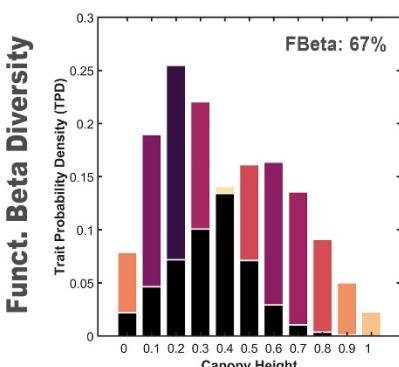
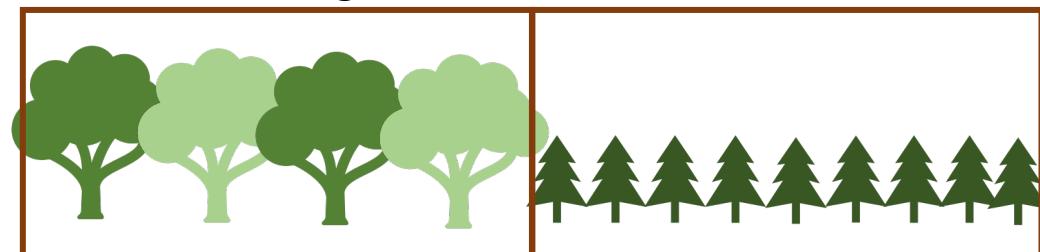
Functional richness and functional beta diversity



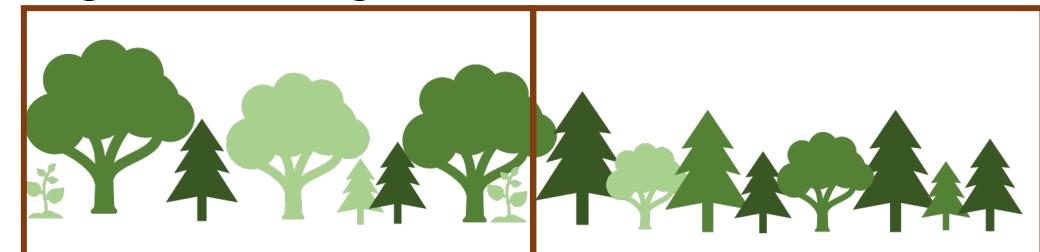
High FRic and low FBeta



Low FRic and high FBeta



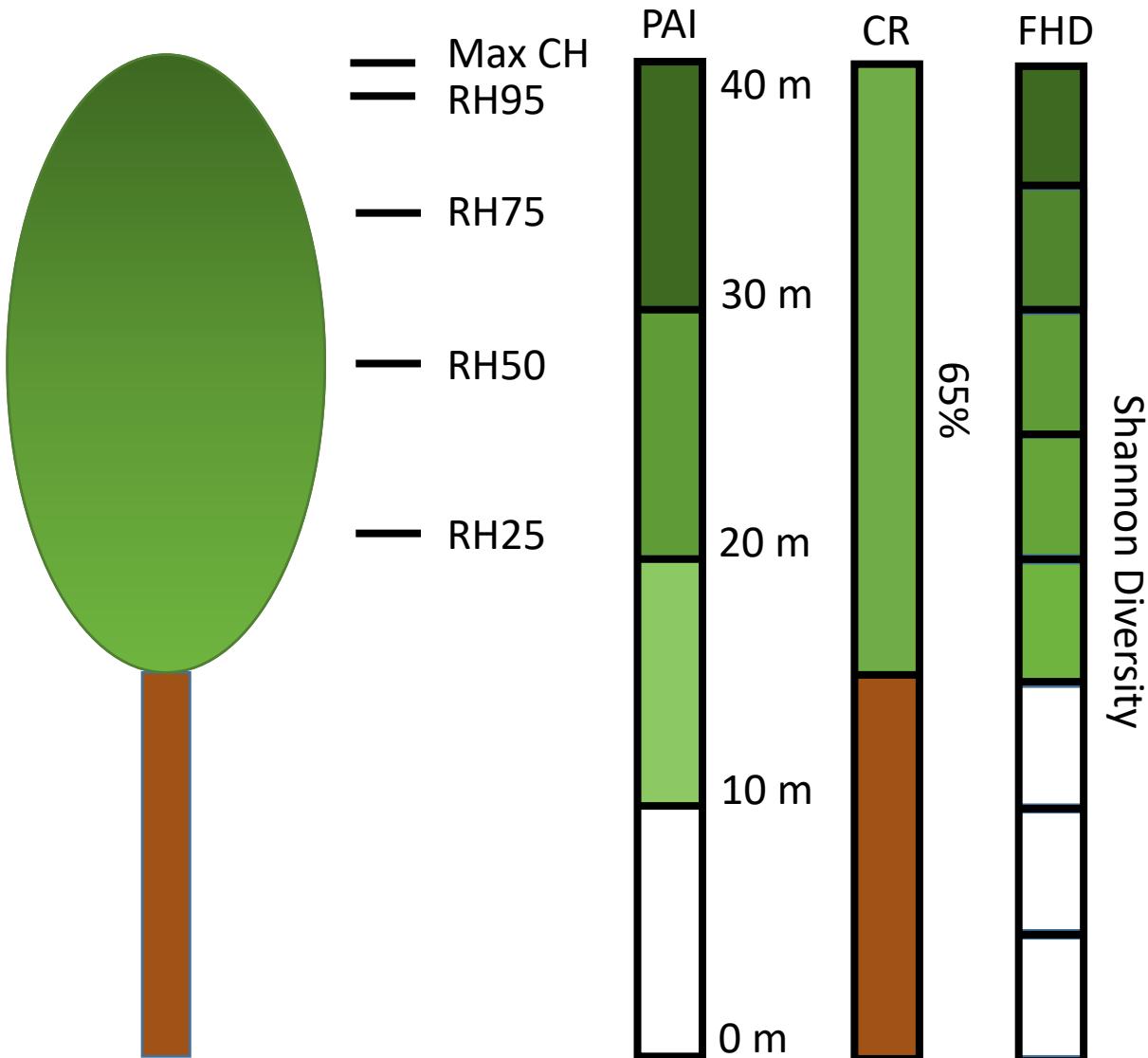
High FRic and high FBeta



Functional traits

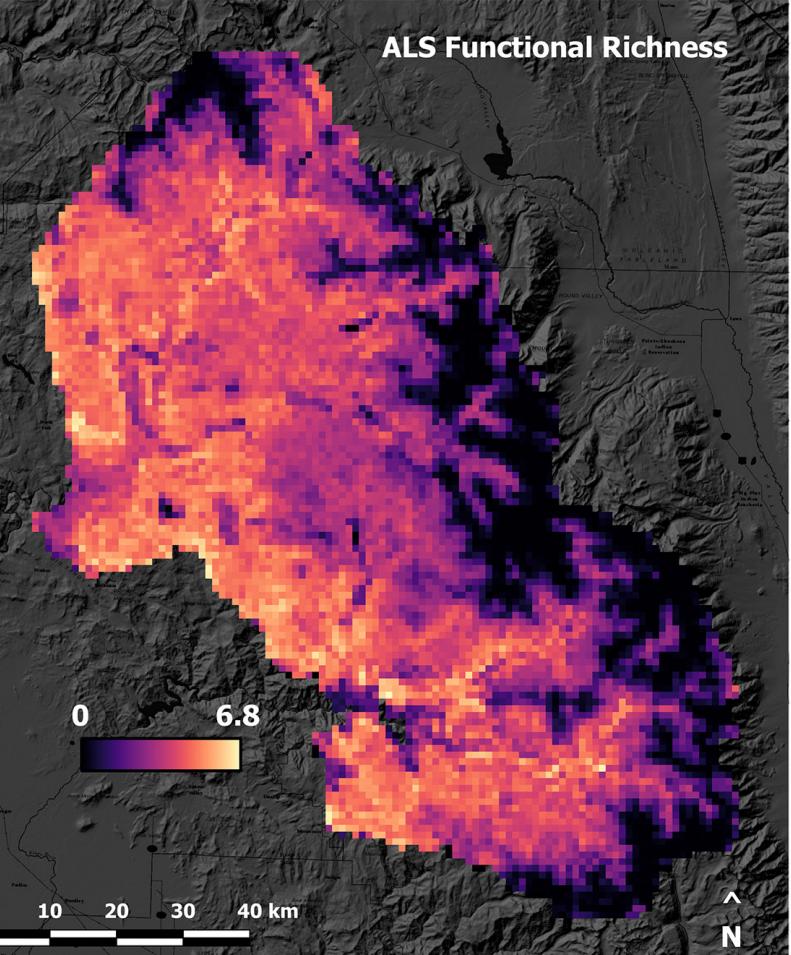
5 Canopy structure traits

- Relative height RH50
- Plant area index (PAI)
- PAI 0-10m
- Canopy Ratio (CR)
- Foliage Height Diversity (FHD)

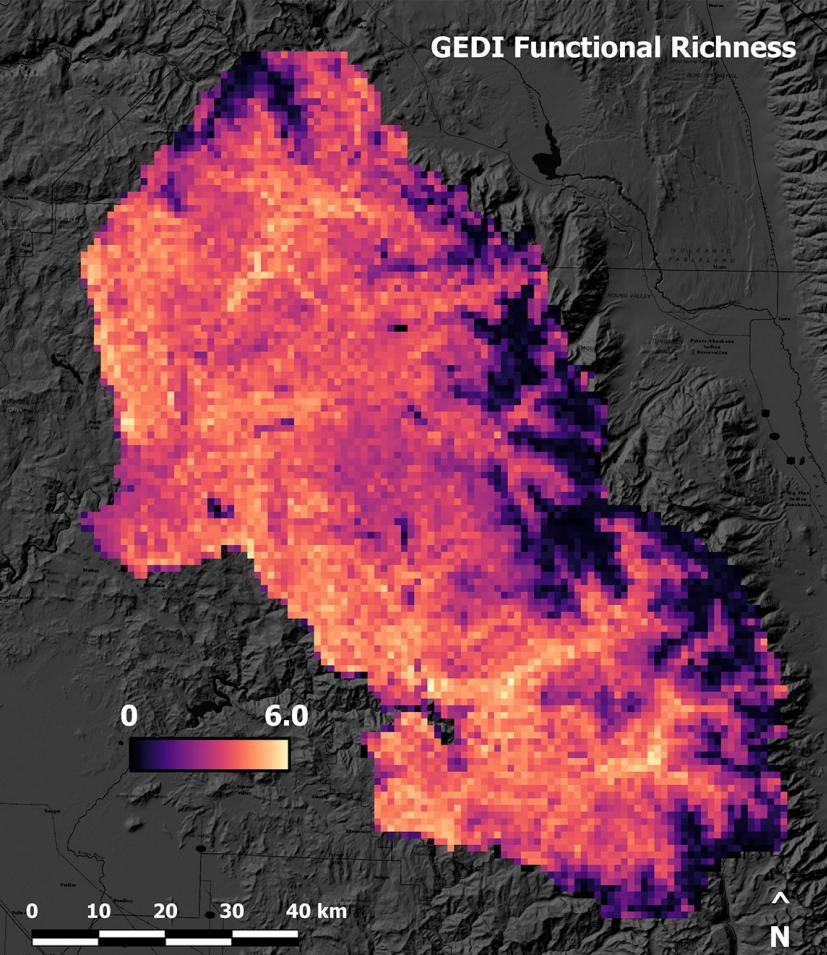


Functional Richness FRic

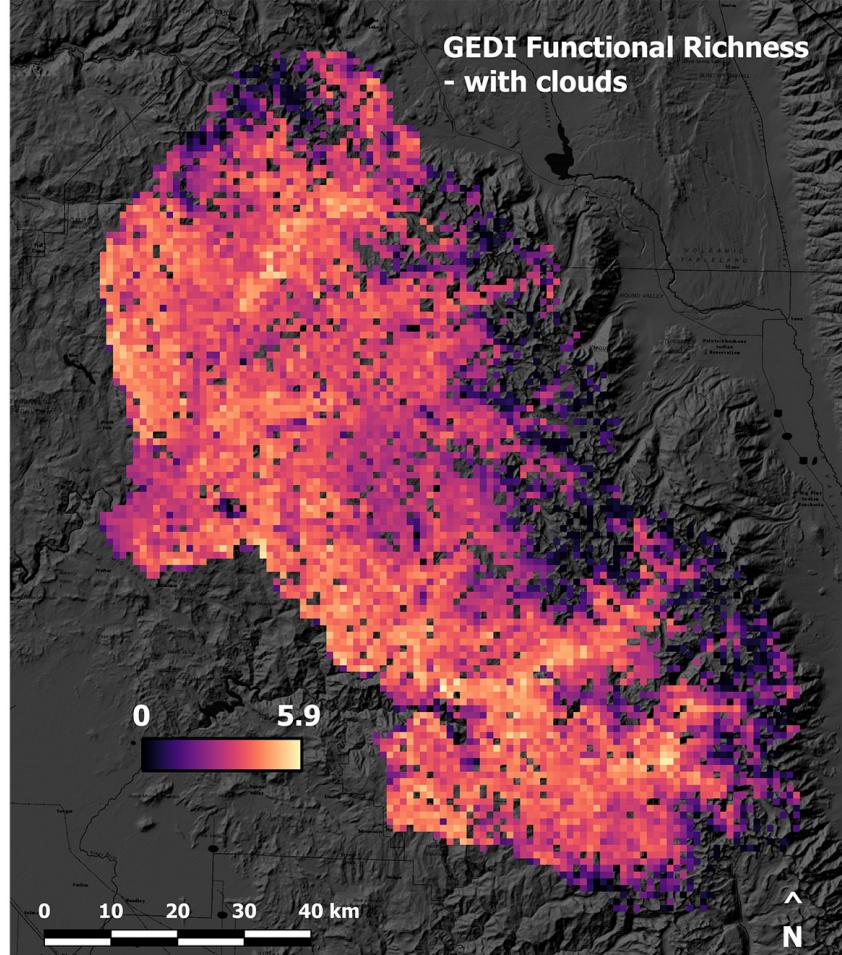
Reference (wall-to-wall airborne)



GEDI, gap-free simulation

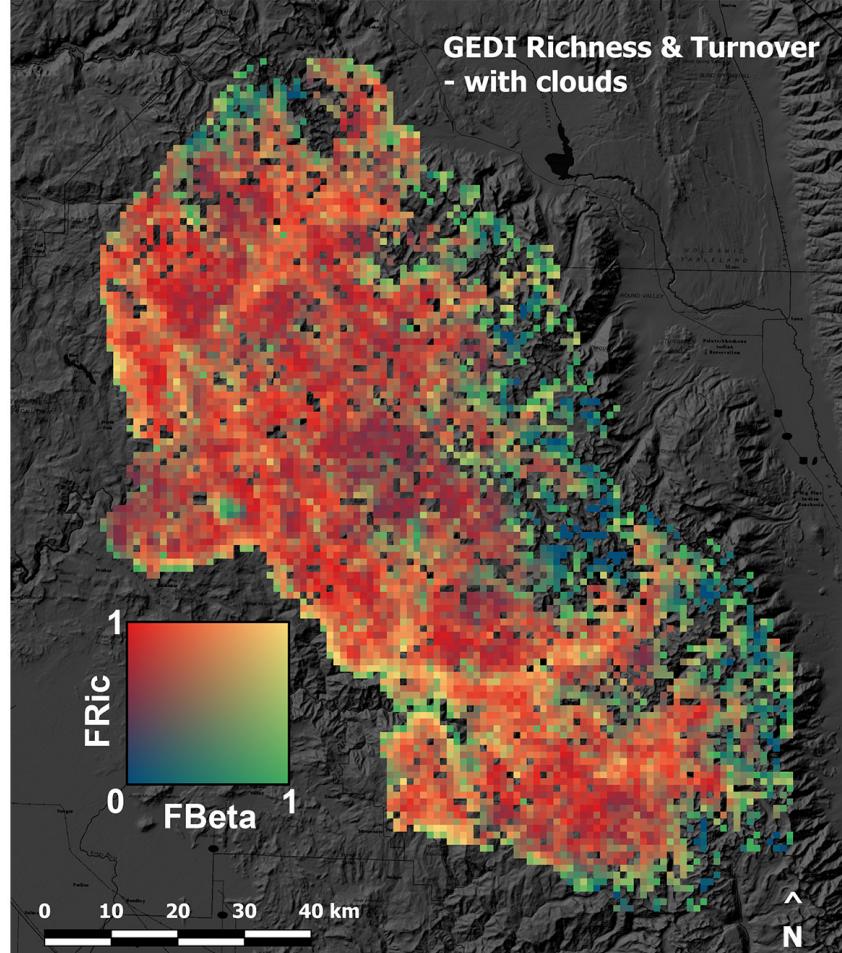
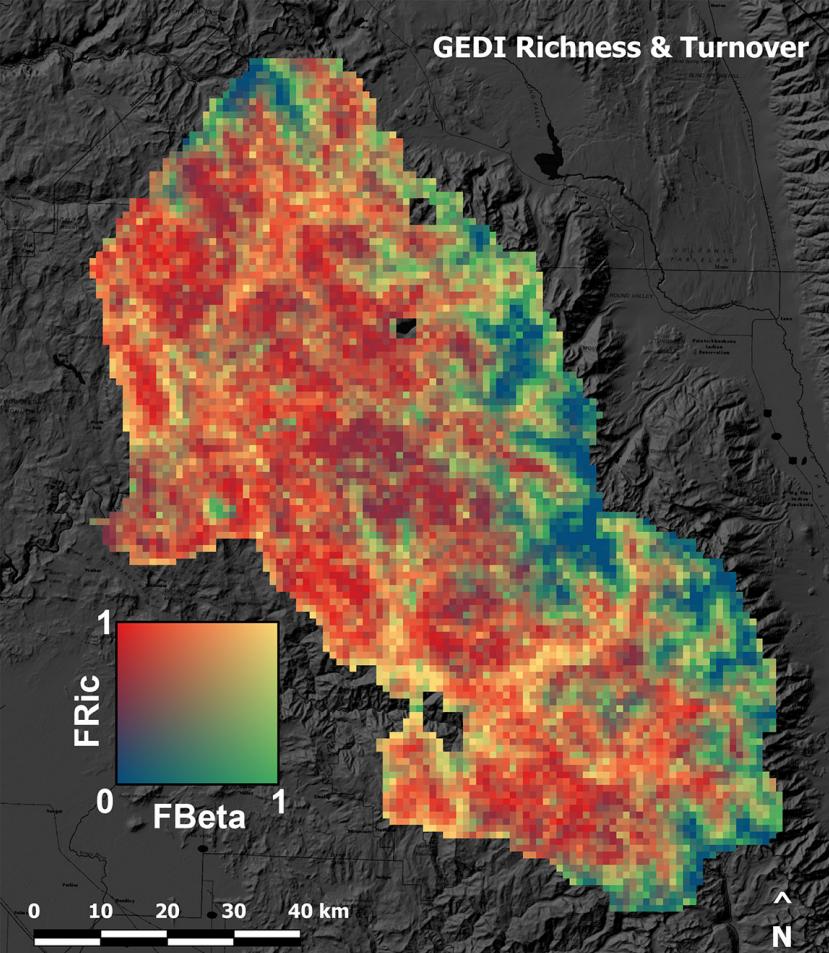
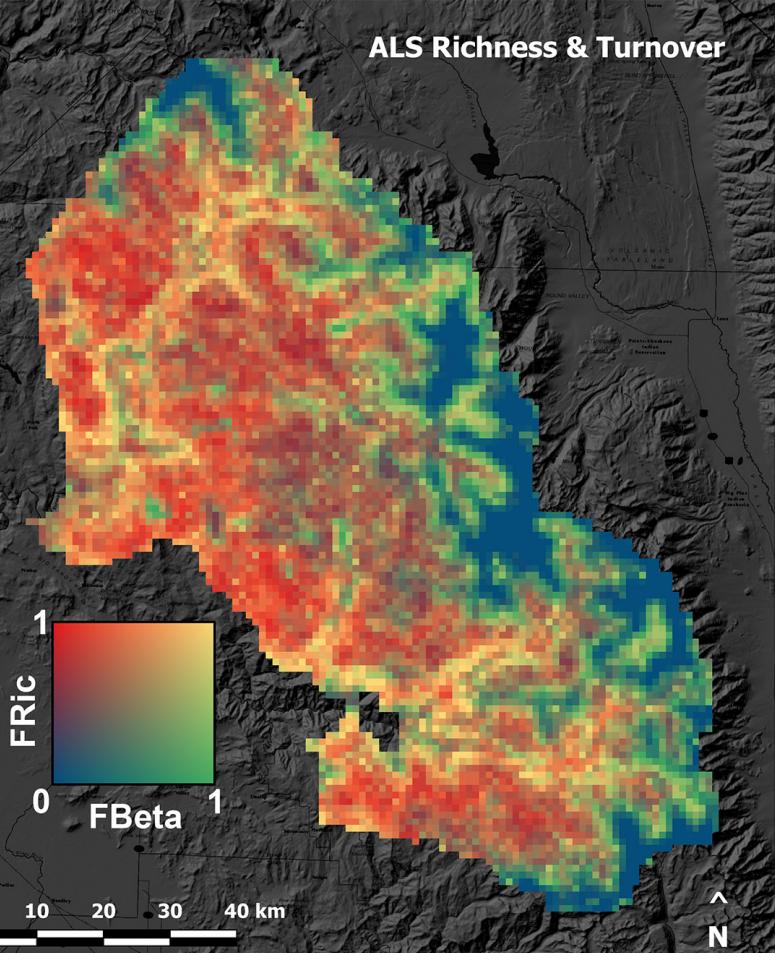


GEDI, simulation with cloud cover



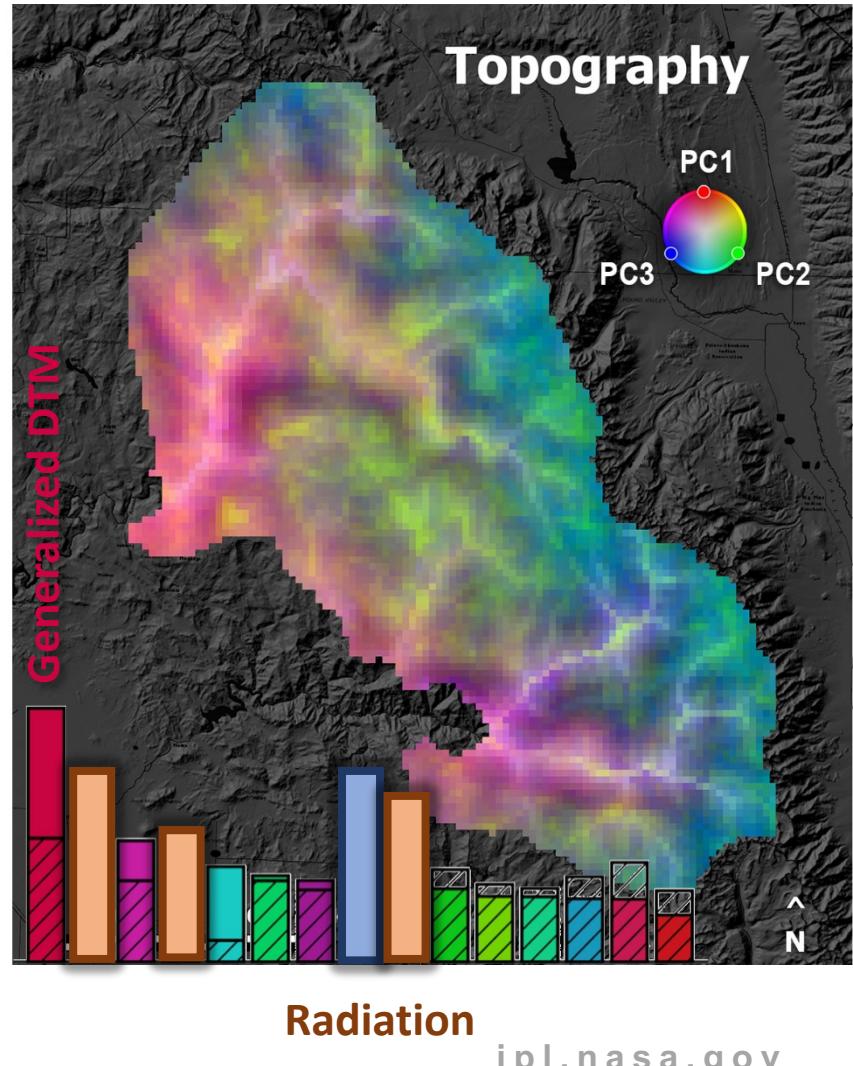
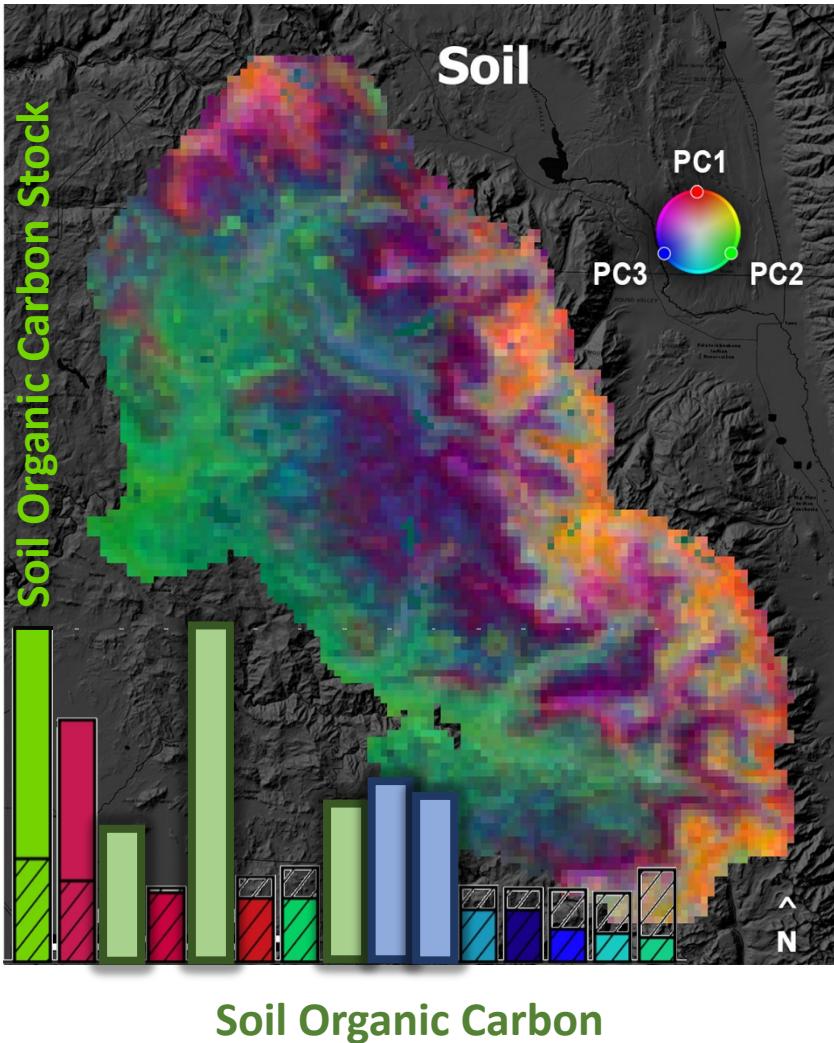
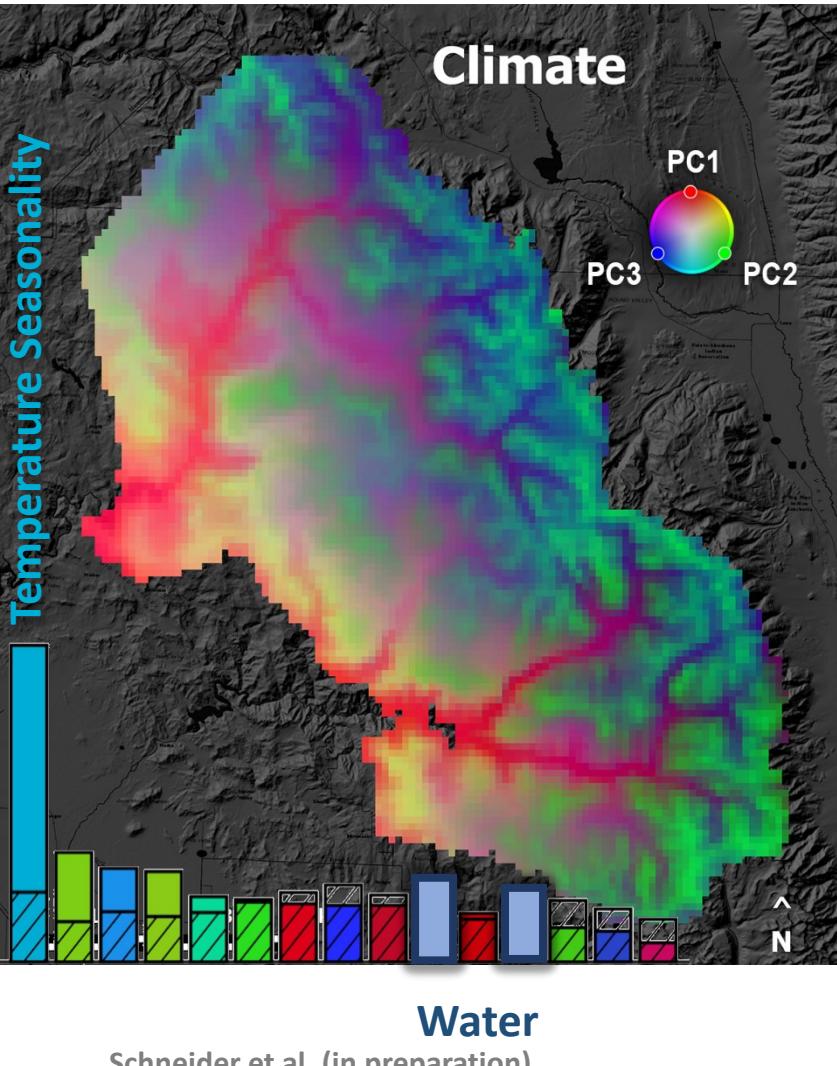
Functional Richness FRic

And Functional Beta Diversity FBeta



Environmental Variables

Explaining patterns of functional richness



Conclusion

Remote Sensing of Plant Functional Diversity From Space

- Imaging spectroscopy can be used to map leaf biochemical and biophysical traits at large spatial scales (30 m grain)
 - Leaf nitrogen, lignin and leaf mass per area
 - See Surface Biology and Geology: <https://sbg.jpl.nasa.gov/>
- Spaceborne laser scanning captures variation in plant canopy structure (1 km extent)
 - Height, density, layering, understory
 - See Global Ecosystem Dynamics Investigation: <https://gedi.umd.edu/>
- Simulated GEDI data showed the potential to map functional richness from space
 - Functional beta diversity shows increasing errors with reduced sampling density



Thank you

Special Thanks to:

JPL Carbon Cycle Group, GEDI Science Team,
Townsend Lab, University of Zurich URPP GCB



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